CLAIMS

We claim:

1. A method of preventing iridium particulates generated during etching of a layer of iridium or an iridium compound in a plasma etch chamber from adversely affecting an etch process subsequently performed in said plasma etch chamber, wherein said method comprises exposing interior surfaces of said plasma etch chamber to a seasoning plasma generated from a gas mixture comprising at least two gases selected from the group consisting of BCl_3, HBr, and CF_4.

2. The method of Claim 1, wherein said method further includes the step of placing a dummy wafer having at least one iridium layer formed thereon in said plasma etch chamber prior to prior to exposing surfaces of said chamber to said seasoning plasma.

3. The method of Claim 1, wherein said plasma etch chamber is a decoupled plasma source etch chamber.

4. The method of Claim 3, wherein a plasma source power within the range of about 1000 W to about 1400 W and a substrate bias power within the range of about 150 W to about 250 W are applied during generation of said seasoning plasma.

5. The method of Claim 4, wherein said plasma source power and said substrate bias power are applied for a time period within the range of about 30 seconds to about 120 seconds.

6. The method of Claim 1, wherein said gas mixture additionally includes argon.

7. The method of Claim 6, wherein said BCl_3 is provided at a flow rate of 30 sccm, said HBr is provided at a flow rate of 30 sccm, said CF_4 is provided at a flow rate of 30 sccm, and said argon is provided at a flow rate of 40 sccm, to said plasma etch chamber.

8. The method of Claim 7, wherein a process chamber pressure within said plasma etch chamber is maintained within the range of about 5 mTorr to about 10 mTorr.

9. The method of Claim 1, wherein said method further includes the step of cleaning the plasma etch chamber with a purge gas prior to exposing surfaces of said chamber to said seasoning plasma.

10. The method of Claim 1, wherein said method further includes the step of purging said plasma etch chamber of remaining seasoning gas mixture after surfaces of said chamber to said seasoning plasma.

11. A method of forming a storage capacitor in a plasma etch chamber, comprising the steps of:

a) exposing interior surfaces of said plasma etch chamber to a seasoning plasma generated from a gas mixture comprising at least two gases selected from the group consisting of BCl_3, HBr, and CF_4;

b) purging said plasma etch chamber of remaining seasoning gas mixture;

c) loading a substrate having at least one iridium layer formed thereon into said plasma etch chamber; and

d) plasma etching said at least one iridium layer.

12. The method of Claim 11, wherein said method further includes the step of placing a dummy wafer having at least one iridium layer formed thereon in said plasma etch chamber prior to prior to exposing surfaces of said chamber to said seasoning plasma.

13. The method of Claim 11, wherein said plasma etch chamber is a decoupled plasma source etch chamber.

14. The method of Claim 13, wherein a plasma source power within the range of about 1000 W to about 1400 W and a substrate bias power within the range of about 150 W to about 250 W are applied during generation of said seasoning plasma.

15. The method of Claim 14, wherein said plasma source power and said substrate bias power are applied for a time period within the range of about 30 seconds to about 120 seconds.

16. The method of Claim 11, wherein said gas mixture additionally includes argon.

17. The method of Claim 16, wherein said BCl_3 is provided at a flow rate of 30 sccm, said HBr is provided at a flow rate of 30 sccm, said CF_4 is provided at a flow rate of 30 sccm, and said argon is provided at a flow rate of 40 sccm, to said plasma etch chamber.

18. The method of Claim 17, wherein a process chamber pressure within said plasma etch chamber is maintained within the range of about 5 mTorr to about 10 mTorr.

19. A method of forming a storage capacitor in a plasma etch chamber, comprising the steps of:

a) loading a substrate having at least one iridium layer formed thereon into said plasma etch chamber;

b) plasma etching said at least one iridium layer;

c) removing said substrate from said plasma etch chamber;

d) cleaning said plasma etch chamber using a purge gas; and

e) exposing interior surfaces of said plasma etch chamber to a seasoning plasma generated from a gas mixture comprising at least two gases selected from the group consisting of BCl_3, HBr, and CF_4.

20. The method of Claim 19, wherein said method further includes the step of placing a dummy wafer having at least one iridium layer formed thereon in said plasma etch chamber prior to prior to exposing surfaces of said chamber to said seasoning plasma.

21. The method of Claim 20, wherein said plasma etch chamber is a decoupled plasma source etch chamber.

22. The method of Claim 21, wherein a plasma source power within the range of about 1000 W to about 1400 W and a substrate bias power within the range of about 150 W to about 250 W are applied during generation of said seasoning plasma.

23. The method of Claim 22, wherein said plasma source power and said substrate bias power are applied for a time period within the range of about 30 seconds to about 120 seconds.

24. The method of Claim 19, wherein said gas mixture additionally includes argon.

25. The method of Claim 24, wherein said BCl_3 is provided at a flow rate of 30 sccm, said HBr is provided at a flow rate of 30 sccm, said CF_4 is provided at a flow rate of 30 sccm, and said argon is provided at a flow rate of 40 sccm, to said plasma etch chamber.

26. The method of Claim 25, wherein a process chamber pressure within said plasma etch chamber is maintained within the range of about 5 mTorr to about 10 mTorr.

27. A method of preventing platinum particulates generated during etching of a layer of platinum in a plasma etch chamber from adversely affecting an etch process subsequently performed in said plasma etch chamber, wherein said method comprises exposing interior surfaces of said plasma etch chamber to a seasoning plasma generated from a gas mixture comprising at least two gases selected from the group consisting of BCl_3, HBr, and CF_4.

28. The method of Claim 27, wherein said platinum particulates are generated during etching of an electrode which includes platinum, iridium oxide (IrO_2), and iridium layers.

29. The method of Claim 27, wherein said gas mixture additionally includes argon.

30. A method of preventing particulates generated from metal etch byproducts, which are nonvolatile at a substrate temperature at which said metal is etched, from adversely affecting an etch process subsequently performed in a plasma etch chamber in which said metal was etched, wherein said method comprises:

a) placing a substrate in said plasma etch chamber; and

b) exposing said substrate, chamber walls, and internal apparatus surfaces of said plasma etch chamber to a seasoning plasma generated from a source gas that includes at least one principal etchant gas used during an etch process which produced said nonvolatile etch byproducts, at a substrate temperature that is equal to or greater than a substrate temperature at which said nonvolatile etch byproducts were produced,

wherein exposure of said substrate to said seasoning plasma generates an entrapment and adhering material which adheres said nonvolatile etch byproducts to chamber walls and internal apparatus surfaces.

31. The method of Claim 30, wherein said substrate includes a material which provides a source for said entrapment and adhering material.

32. The method of Claim 31, wherein said substrate includes an inorganic material which provides a source for said entrapment and adhering material.

33. The method of Claim 32, wherein said method is performed at a substrate temperature of 250°C or greater.

34. The method of Claim 32, wherein said method is performed at a substrate temperature less than 250°C.

35. The method of Claim 31, wherein said substrate includes an organic material which provides a source for said entrapment and adhering material, and wherein said method is performed at a substrate temperature less than 250°C.

36. The method of Claim 30, wherein said seasoning plasma includes a gas which provides a source for said entrapment and adhering material.

37. The method of Claim 37, wherein said seasoning plasma includes a carbon-containing gas.

38. A method of preventing particulates generated from metal etch byproducts, which are nonvolatile at a substrate temperature at which said metal is etched, from adversely affecting an etch process subsequently performed in a plasma etch chamber in which said metal was etched, wherein said method comprises:

a) placing a substrate which includes a material which provides a source for an entrapment and adhering material; and

b) exposing said substrate, chamber walls, and internal apparatus surfaces of said plasma etch chamber to a seasoning plasma generated from a gas selected from the group consisting of Cl_2, a chlorine-containing compound, and combinations thereof, at a substrate temperature that is equal to or greater than a substrate temperature at which said nonvolatile etch byproducts were produced,

wherein exposure of said substrate to said seasoning plasma generates said entrapment and adhering material which adheres said nonvolatile etch byproducts to chamber walls and internal apparatus surfaces.

39. The method of Claim 38, wherein said substrate includes an inorganic material which provides a source for said entrapment and adhering material.

40. The method of Claim 39, wherein said inorganic material is a dielectric selected from the group consisting of silicon oxide, silicon nitride, aluminum oxide, and combinations thereof.

41. The method of Claim 39, wherein said method is performed at a substrate temperature of 250°C or greater.

42. The method of Claim 41, wherein a metal which is etched within said plasma etch chamber is selected from the group consisting of platinum, iridium, and combinations thereof, and wherein said method is performed at a substrate temperature of at least 260°C, for a time period ranging from about 2 minutes to about 30 minutes.

43. The method of Claim 39, wherein said method is performed at a substrate temperature less than 250°C.

44. The method of Claim 43, wherein a metal which is etched in said plasma etch chamber is copper, and wherein said method is performed at a substrate temperature of at least 210°C, for a time period ranging from about 2 minutes to about 30 minutes.

45. The method of Claim 43, wherein a metal which is etched in said plasma etch chamber is selected from the group consisting of a nickel-iron alloy, a cobalt-iron alloy, and a nickel-iron-cobalt alloy, and wherein said method is performed at a substrate temperature of at least 25°C, for a time period ranging from about 2 minutes to about 30 minutes.

46. The method of Claim 38, wherein said substrate includes an organic material which provides a source for said entrapment and adhering material, and wherein said method is performed at a substrate temperature less than 250°C.

47. The method of Claim 46, wherein said organic material is a photoresist.

48. A method of preventing particulates generated from metal etch byproducts, which are nonvolatile at a substrate temperature at which said metal is etched, from adversely affecting an etch process subsequently performed in a plasma etch chamber in which said metal was etched, wherein said method comprises:

a) placing a substrate which provides a source of a dielectric material in said plasma etch chamber; and

b) exposing said substrate, chamber walls, and internal apparatus surfaces of said plasma etch chamber to a seasoning plasma generated from a gas selected from the group consisting of Cl_2, a chlorine-containing compound, and combinations thereof, at a substrate temperature that is equal to or greater than a substrate temperature at which said nonvolatile etch byproducts were produced,

wherein exposure of said substrate to said seasoning plasma generates said dielectric material which adheres said nonvolatile etch byproducts to chamber walls and internal apparatus surfaces.

49. The method of Claim 48, wherein said metal is selected from the group consisting of platinum, iridium, copper, a nickel-iron alloy, a cobalt-iron alloy, a nickel-iron-cobalt alloy, and combinations thereof.

50. The method of Claim 48, wherein said dielectric material is selected from the group consisting of silicon oxide, silicon nitride, aluminum oxide, and combinations thereof.

51. The method of Claim 48, wherein said seasoning plasma further includes a noble gas selected from the group consisting of argon, helium, xenon, krypton, and combinations thereof.

52. The method of Claim 51, wherein said seasoning plasma is generated from a gas mixture comprising Cl_2 and argon, wherein Cl_2 comprises about 50 to about 90 volume %, and argon comprises about 10 to about 50 volume %, of said gas mixture.

53. The method of Claim 52, wherein Cl_2 comprises about 60 to about 80 volume %, and argon comprises about 20 to about 40 volume %, of said gas mixture.

54. The method of Claim 51, wherein said seasoning plasma is generated from a gas mixture comprising Cl_2, argon, and N_2, wherein Cl_2 comprises about 40 to about 90 volume %, argon comprises about 10 to about 50 volume %, and N_2 comprises about 1 to about 20 volume %, of said gas mixture.

55. The method of Claim 54, wherein Cl_2 comprises about 60 to about 80 volume %, argon comprises about 10 to about 30 volume %, and N_2 comprises about 5 to about 20 volume %, of said gas mixture.

56. The method of Claim 48, wherein said seasoning plasma is generated from a source gas comprising Cl_2 and a chlorine-containing compound selected from the group consisting of HCl, BCl_3, $SiCl_4$, and combinations thereof.

57. The method of Claim 56, wherein said source gas further includes a gas which enhances dissociation of said chlorine-containing compound into active chlorine species.

58. The method of Claim 57, wherein said chlorine-dissociation-enhancing gas is selected from the group consisting of N_2, NH_3, and combinations thereof.

59. The method of Claim 48, wherein said seasoning plasma is generated from a source gas comprising a chlorine-containing compound selected from the group consisting of HCl, BCl_3, $SiCl_4$, and combinations thereof, and wherein said source gas further includes a gas which enhances dissociation of said chlorine-containing compound into active chlorine species.

60. The method of Claim 59, wherein said chlorine-dissociation-enhancing gas is selected from the group consisting of N_2, NH_3, and combinations thereof.